RAPIDPOINT® 400/405
Systems

Rapidpoint® 400 Series Systems

Interface Specifications Manual

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Implementing an LIS software interface to a Rapidpoint® 400 series system is solely the responsibility of the customer. Siemens recommends that a professional software programmer develop and implement the LIS software interface. Siemens is not responsible for any communications problems or for any damage to a Rapidpoint 400 series system or an LIS that might result from implementing an LIS communication protocol.

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Using this Manual

The *Rapidpoint 400/405 Systems Interface Specification Manual* describes the specifications for interfacing a Rapidpoint® 400 series system to a laboratory information system (LIS) or a hospital information system (HIS). This manual is descriptive rather than procedural and provides the following information:

- message formats
- physical interface specifications

Who Should Use this Manual

Software engineers and programmers should use this manual as a reference document when programming the LIS to use data generated by a Rapidpoint 400 series system. The laboratory information system manager can refer to this manual to identify the appropriate communication protocol.

Finding Information in this Manual

The following table helps you locate the manual sections that contain the information you need to complete interface tasks.

If you want to . . .	*Then refer to . . .*
find general information about the LIS 3 communication protocol	Section 1, *Overview.*
identify the specifications for the physical interface between a Rapidpoint 400 series system and a laboratory information system	Section 5, *Physical Interface*.
find information about message transactions	Section 2, *Message Transactions*.
find information about the message format	Section 3, *Message Format*.
find information about message transfer	Section 4, *Message Transfer.*
review variables and data records for LIS 3 protocol	Appendix A, *Variables*, and Appendix B, *Data Records*.

Rapidpoint 400 Series Operator's Manual

The *Rapidpoint 400 Series Operator's Manual* contains operating, setup, and troubleshooting information for the Rapidpoint 400 series system operator. Refer to Appendix E in the *Rapidpoint 400 Series Operator's Manual* for the procedures to connect a Rapidpoint 400 series system to an LIS.

Conventions Used in this Manual

The following table explains the text and symbol conventions used in this manual.

Convention	*Description*
{...}	Braces delimit records. For example, {identifier} indicates an identifier record.
<...>	Angle brackets indicate ASCII control characters. For example, <STX> indicates Start of Text (02 decimal).
NOTE:	The note symbol identifies information that requires your attention.

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1 Overview

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Overview

The Rapidpoint 400 series system is designed to transmit patient sample data, quality control (QC) sample data, and system calibration data to a laboratory information system (LIS) or to a hospital information system (HIS). Transmission of patient sample, QC sample, and calibration data can be automatic or only upon the request of the LIS or operator.

About the Rapidpoint 400 Series System

The Rapidpoint 400 series system is used for the determination of pH, *p*CO2, *p*O2, sodium (Na^+), potassium (K^+), ionized calcium (Ca^{++}), chloride (Cl^-), glucose (Glu), hematocrit (Hct), total hemoglobin (tHb) and hemaglobin derivatives in arterial, venous, mixed venous, and capillary whole blood samples. The system can report the following parameters:

Parameter	*Description*
pH	negative logarithm of the hydrogen ion activity
or	*or*
H^+	hydrogen ion activity
pCO_2	carbon dioxide (partial pressure)
pO_2	oxygen tension (partial pressure)
Na^+	sodium ion concentration
K^+	potassium ion concentration
Ca^{++}	calcium ion concentration
Cl^-	chloride ion concentration
Glu	glucose concentration
Hct	hematocrit
HCO_3–act	actual bicarbonate
HCO_3-std	standard bicarbonate
BE(B)	base excess of blood
BE(ecf)	base excess of extracellular fluid
$ctCO_2$	total carbon dioxide
pH(T)	temperature-corrected pH
pCO_2(T)	temperature-corrected pCO2
pO_2(T)	temperature-corrected pO2
RI(T)	respiratory index

(Continued)

Parameter	Description
pO_2(A-a)(T)	alveolar-arterial oxygen tension diference
pO_2(a/A)(T)	alveolar-arterial oxygen tension ratio
Qsp/Qt(T)	physiologic shunt
Qsp/Qt(T)(est)	estimated physiologic shunt
O_2SAT(est)	estimated oxygen saturation
Hct	calculated hematocrit
ctHb(est)	estimated total hemoglobin
pO_2/F_IO_2	partial pressure of oxygen/fraction of inspired oxygen
Ca^{++} (7.4)	calcium ion concentration adjusted to pH 7.40
AnGap	anion gap
ctO_2(a-v)	arterial-venous oxygen content difference
ctO_2(a)	arterial oxygen content
ctO_2(v)	mixed venous oxygen content
VO_2	oxygen consumption rate
DO_2	oxygen delivery
ctO_2([a-v]/a)	a-v extraction index
tHb	total hemoglobin
FO_2Hb	oxyhemoglobin
*F*COHb	carboxyhemoglobin
*F*MetHb	methemoglobin
*F*HHb	deoxyhemoglobin
sO_2	hemoglobin oxygen saturation
BO_2	oxygen binding capacity
p50	oxygen tension at 50% saturation

About the Communication Protocol

The Rapidpoint 400 series system uses the LIS 3 protocol. The protocol transmits patient, QC, and calibration data from the system to the LIS or HIS upon the request of the LIS. Messages are enclosed within control characters so that the LIS can detect the start and end of transmission. Each message also includes a checksum to enable the detection of bad transmissions. Messages are automatically retransmitted one time if the LIS does not acknowledge a transmission.

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About Message Transactions

The protocol supports the following transactions:

- Device Identify

  The Rapidpoint 400 series system informs the LIS to identify itself; the LIS transmits its model and device ID to the system. If the LIS makes the request, then the Rapidpoint 400 series system transmits its model and device ID to the LIS.

- Patient Sample Assay

  The Rapidpoint 400 series system informs the LIS that patient data is available, the LIS requests the data, and the system transmits the requested data.

- QC Assay

  The Rapidpoint 400 series system informs the LIS that QC data is available, the LIS requests the data, and the system transmits the requested data.

- Calibration

  The Rapidpoint 400 series system informs the LIS that calibration data is available, the LIS requests the data, and the system transmits the requested data.

- System Status

  The Rapidpoint 400 series system informs the LIS of its status (for example, the system is ready for analysis).

- System Control

  The LIS sends commands to the Rapidpoint 400 series system that affect system operation (for example, turning on and turning off parameters).

- Date / Time

  The LIS requests the Rapidpoint 400 series system date and time, and the system transmits the requested data.

Most of these transactions require multiple messages to complete the transaction. The following sections detail the transactions. Refer to Section 3, *Message Format*, for a description of the message format, and to Appendix B, *Data Records,* for a list of the fields present in the larger data records.

Data Availability and Identification

Under the following circumstances, the Rapidpoint 400 series system informs the LIS that the system has data available to transmit:

- at the completion of sample analysis, quality control (QC) analysis, or calibration when Auto Send is on
- when Auto Send is on and the system operator recalls, edits, and saves patient demographic data by touching the Continue button, and when an a-v study report is created
- when the operator prints a report

The protocol includes a mechanism for requesting a retransmission of data upon detection of a transmission error. This mechanism uses a relatively simple message acknowledgment protocol that allows one retry. Refer to *Message Acknowledgement* in Section 4.

The protocol does not detect when the same, error-free message is transmitted twice. This situation can occur when the LIS acknowledges an error-free message but the acknowledgment is corrupted, causing the Rapidpoint 400 series system to resend the message. If the receipt of duplicate data is a problem for the LIS application, then the LIS can check each data message to ensure it is not a duplicate of the preceding message.

The transmission of duplicate data messages can also occur in an error-free environment when the operator recalls data and makes multiple requests for results to be sent to the LIS. For example, if the operator prints the same patient report more than once, the Rapidpoint 400 series system sends data available message to the LIS each time the report is printed.

The messages are enclosed within control characters to allow for the detection of start and end of transmission. The messages also include a checksum to enable the detection of bad transmissions. To aid in the parsing of messages, delimiters are used to identify variable boundaries. For more information, refer to Section 4, *Message Transfer.*

Sequence Numbers

Upon completion of analysis or calibration, the Rapidpoint 400 series system assigns a sequence number to each new patient analysis, QC analysis, or calibration. The sequence starts at 1, increments to 2^{32}, and then, if necessary, begins again at 1.

When the Rapidpoint 400 series system saves new patient, QC, or calibration data, it also notifies the LIS that the data, identified by its sequence number, is available. To obtain the data, the LIS must request the data by specifying the sequence number in the data request message the LIS sends to the Rapidpoint 400 series system. For example, the system notifies the LIS that patient data with sequence number 123 is available and the LIS requests the patient data for sequence number 123.

The LIS does not have to request the data immediately after notification. The LIS can wait until it is informed that additional data is available and then request data for specific sequence numbers, with the assurance that the data is still available. This feature allows the LIS time to act and avoids delaying the system before being allowed to make the next transaction available.

If the LIS requests data that is not in the system database, the system informs the LIS that the data is not available.

Buffering and Queue Clearing

Data is stored and queued by the Rapidpoint 400 series system until the database capacity is exceeded. When the database is full, the oldest sample sequences are removed to create space to store new sample data. Refer to the *Rapidpoint 400 Series Operator's Manual* for the current storage capacity of the database.

If the Rapidpoint 400 series system and LIS connection is interrupted, the system will queue all unsent patient and QC sample results and calibration data. When the connection is re-established, the system sends the queued data to the LIS. The most recent results are sent first. This process takes place below current transactions and does not interrupt or affect use of the Rapidpoint 400 series system.

The Rapidpoint 400 series system sends queued data, with a minimum 10 second delay between transmissions, in the following order:

- all patient sample results
- all QC data
- all calibration data

Each data set is sent in chronological order, starting with the data most recently generated.

Device Identify Transaction

The device sending data (either the Rapidpoint 400 series system or the LIS) requests the device receiving data (the LIS or the Rapidpoint 400 series system, respectively) to identify itself. The device receiving data responds by sending its model and device ID.

Both the Rapidpoint 400 series system and the LIS can initiate a device identify transaction at any time by sending the following message:

Request device identity: {ID_REQ}

The receiving device responds by sending a data record containing the name and value of the variables aMOD (the model number) and iIID (the device identifier). The device uses the following message:

Device identifier: {ID_DATA}{aMOD, iIID}

The device identify transaction must be implemented in the LIS for the system to recognize the LIS connection.

The contents of the aMOD and iIID fields must be as follows:

Field	*Rapidpoint 400 Series System*	*LIS*
aMOD	040n where n is the type of system configuration	LIS
iIID	up to 6 alphanumeric characters	up to 6 alphanumeric characters

The aMOD value appears in the system ID on printed reports and on the System Information screen.

Instrument Identifier Field

The instrument identifier field (iIID) enables the LIS and the Rapidpoint 400 series system to identify systems with the same aMOD to which a message is directed. All system transactions require the iIID field.

The iIID value is taken from the Serial Number field. The system serial number (for example, 12345) is entered during system setup by the service engineer.

The iIID value appears in the System ID on printed reports and on the System Information screen.

Patient Sample Assay Transaction

The Rapidpoint 400 series system informs the LIS that patient data is available, the LIS requests the data, and the system transmits the requested data. The Rapidpoint 400 series system initiates this transaction.

If the Rapidpoint 400 series system . . .	*Then the LIS . . .*
notifies the LIS that a patient sample analysis has begun or been canceled	acknowledges the message.
notifies the LIS that new or edited patient data is available	acknowledges the message; the LIS at anytime requests the data and identifies the sequence number of the requested data.
sends the requested data or notifies the LIS that the data is no longer available	acknowledges the message.

Measurement Status

When a patient sample analysis has begun, the system informs the LIS by sending the following message (iOID appears if the operator logged in):

> Patient sample analysis initiated: {SMP_START}{aMOD, iIID, aDATE, aTIME, iOID}

If the operator cancels the analysis sequence or the operation fails due to a system error, the system informs the LIS (iOID appears if the operator logged in):

> Patient sample analysis canceled: {SMP_ABORT}{aMOD, iIID, aDATE, aTIME, iOID}

Rapid Sample Identification Transaction

Rapid Sample Identification is a setup option that allows the Rapidpoint 400 series system to query the LIS system for patient demographic information based on the patient ID entered at the system. This feature is used to confirm that the patient ID, entered by the operator, matches the patient.

With Rapid Sample Identification turned on, when a patient ID is entered, the system informs the LIS by sending the following message:

> Rapid Sample Identification Requested: {PAT_DEMOG_REQ} {aMOD, illD, iPID}

The LIS responds in one of the following three ways:

- the patient demographic data was found for the requested patient ID by sending the following message:

  > Rapid Sample Identification Data: {PAT_DEMOG_DATA} {aMOD, illD, iPID, iLNAME, iFNAME, iSEX, iDOB}

- the patient demographic data was not found for the requested patient ID by sending the following message:

  Rapid Sample Identification Data Not Found: {PAT_DEMOG_NOT_AV} {aMOD, illD, iPID}

- the LIS does not respond. After 60 seconds, the system assumes that the data could not be found and informs the operator.

Data Available

The Rapidpoint 400 series system notifies the LIS that the system has data to transmit:

- at the completion of sample analysis when Auto Send is on
- when Auto Send is on and the system operator recalls, edits, and saves patient demographic data by touching the Continue button
- when the operator prints a report
- when clearing a queue

When patient sample data is available, the system sends the following message to the LIS:

Sample data available: {SMP_NEW_AV}{aMOD, iIID, rSEQ}

NOTE: The sample sequence number does not increment with retransmissions.

Request Sample Data

When informed that data is available, the LIS may request the data by sending the following message, which identifies the sequence number of the requested sample data:

Request patient sample data: {SMP_REQ}{aMOD, iIID, rSEQ}

Sample Assay Data

If the requested data is available, the system sends the following message:

Sample data: {SMP_NEW_DATA}{sample assay data}

The sample type and the parameters configured on the system can affect the parameters transmitted in the sample assay data record. Refer to Appendix B, *Data Records*, for the sample assay data record.

Sample Assay Data Not Available

If the requested data is no longer available, the system sends the following message:

Patient sample data not available: {SMP_NOT_AV}{aMOD, iIID, rSEQ}

The data may not be available if the database is full. When the database is full, the oldest sample sequences are removed to create space to store new sample data.

Edited Sample Data

When the system operator recalls patient sample data, edits the data, and then sends the results to the LIS, the system sends the following message:

Sample data available: {SMP_NEW_AV}{aMOD, iIID, rSEQ}

When the LIS responds with the SMP_REQ message, the system sends the following message:

Edited patient sample data: {SMP_EDIT_DATA}{sample assay data}

NOTE: An a-v study can be performed on a Rapidpoint 405 system when the operator combines an arterial and a mixed-venous sample. After combining samples, only the arterial sample is available for printing and sending to the LIS.

QC Assay Transaction

The Rapidpoint 400 series system informs the LIS that QC data is available, the LIS requests the data, and the system transmits the requested data. The Rapidpoint 400 series system initiates the transaction.

If the Rapidpoint 400 series system . . .	*Then the LIS . . .*
notifies the LIS that a QC sample analysis has begun or been canceled	acknowledges the message.
notifies the LIS that new QC data is available	acknowledges the message; the LIS at anytime requests the QC data and identifies the sequence number of the requested data.
sends the requested QC data or notifies the LIS that the data is no longer available	acknowledges the message.

Measurement Status

When QC sample analysis has begun, the system informs the LIS (iOID appears if the operator logged in):

QC sample analysis initiated: {QC_START}{aMOD, iIID, aDATE, aTIME, iOID}

If the operator cancels the QC analysis sequence, or the operation fails due to a system error, the system informs the LIS with the following message (iOID appears if the operator logged in):

QC sample analysis canceled: {QC_ABORT}{aMOD, iIID, aDATE, aTIME, iOID}

Data Available

The Rapidpoint 400 series system informs the LIS that the system has QC data to transmit:

- at the completion of QC analysis when Auto Send is on
- when the operator prints a report
- when clearing a queue

The system sends the following message to the LIS when QC data is available:

QC sample data available: {QC_NEW_AV}{aMOD, iIID, rSEQ}

NOTE: The QC sample sequence number does not increment with retransmissions.

Request QC Data

When informed that QC data is available, the LIS may request the data by sending the following message, which identifies the sequence number of the required QC data:

Request QC data: {QC_REQ}{aMOD, iIID, rSEQ}

QC Assay Data

If the requested QC data is available, the system sends the following message:

QC data: {QC_NEW_DATA}{QC assay data}

Refer to Appendix B, *Data Records,* for the QC assay data record.

QC Assay Data Not Available

If the requested QC data is no longer available, the system sends the following message:

QC data not available: {QC_NOT_AV}{aMOD, iIID, rSEQ}

The data may not be available if the database is full. When the database is full, the oldest sample sequences are removed to create space to store new sample data.

Calibration Transactions

The Rapidpoint 400 series system informs the LIS that new calibration data is available, the LIS requests the data, and the system transmits the requested data. The transaction is initiated by the Rapidpoint 400 series system.

If the Rapidpoint 400 series system . . .	*Then the LIS . . .*
notifies the LIS that a calibration sequence has begun or been canceled	acknowledges the message.
notifies the LIS that calibration data is available	acknowledges the message; the LIS at anytime requests the calibration data and identifies the sequence number of the requested data.
sends the requested calibration data or notifies the LIS that the data is no longer available	acknowledges the message.

Calibration Initiated

When a calibration sequence has begun, the system informs the LIS (iOID appears if the operator logged in):

Calibration initiated: {CAL_START}{aMOD, iIID, aDATE, aTIME, iOID}

If the operator cancels the calibration sequence, or if the calibration fails due to a system error, the system informs the LIS with the following message (iOID appears if the operator logged in):

Calibration canceled: {CAL_ABORT}{aMOD, iIID, aDATE, aTIME, iOID}

Data Available

The Rapidpoint 400 series system informs the LIS that the system has calibration data to transmit:

- at the completion of calibration when Auto Send is on
- when the operator prints a report
- when clearing a queue

The system sends the following message to the LIS when calibration data is available:

Calibration: {CAL_NEW_AV}{aMOD, iIID, rSEQ}

NOTE: The calibration sequence number does not increment with retransmissions.

Request Calibration Data

When informed that calibration data is available, the LIS may request the data by sending the following message, which identifies the sequence number of the requested calibration data:

Request calibration data: {CAL_REQ}{aMOD, iIID, rSEQ}

Calibration Data

If the requested calibration data is available, the system sends the following message:

Cal data: {CAL_NEW_DATA}{calibration data}

The calibration data records sent by the Rapidpoint 400 series system depend on the type of calibration performed. The calibration data record contains either a cal data set, a slope data set, or both.

Calibration Sequences	*Data Set*
1-point	cal
2-point	cal and slope
2-point	cal, slope, and Hct slope

Within each cal and slope data set, each parameter is represented by two entries. In the variable name, *name* is replaced by the name of a particular parameter, such as aCmNa$^+$ or aSdNa$^+$.

	CAL		*SLOPE*
Format	*Function*	*Format*	*Function*
aCmname	(MEASURED)	aSmname	(MEASURED)
aCdname	(DRIFT)	aSdname	(DRIFT)

The first entry (MEASURED) is the measured calibrant or slope value. The second entry (DRIFT) is the drift in calibration or slope for that parameter.

NOTE: The Rapidpoint 400 series system deviates from the 200 and 800 Series systems in the representation of calibration data because the Rapidpoint 400 series system does not include an ADJUSTED number.

Refer to Appendix B, *Data Records*, for the calibration data records.

Calibration Data Not Available

If the requested data is no longer available, the system sends the following message:

Cal data not available: {CAL_NOT_AV}{aMOD, iIID, rSEQ}

The data may not be available if the database is full. When the database is full, the oldest sample sequences are removed to create space to store the new sample data.

System Status Transactions

Several system status messages inform the LIS about the status of the Rapidpoint 400 series system.

System Ready

The system ready message informs the LIS when the system is ready to accept a sample. The system sends the following message when analysis is complete and the system is ready to accept a new sample (iOID appears if the operator logged in):

System ready: {SYS_READY}{aMOD, iIID, aDATE, aTIME, iOID}

System Not Ready

The system not ready message informs the LIS when the system is not ready to accept a new sample, such as when the operator is replacing a cartridge. If the system is not ready, it sends the following message (iOID appears if the operator logged in):

System not ready: {SYS_NOT READY}{aMOD, iIID, aDATE, aTIME, iOID}

System Waiting Operator Action

The system sends the waiting operator action message during analysis if the system is delayed during analysis and is waiting for the operator to take action (for example, if the system is waiting for the operator to remove the sample device). The system sends the following message (iOID appears if the operator logged in):

System waiting: {SYS_WOPR}{aMOD, iIID, aDATE, aTIME, iOID}

System Measuring

When the system resumes analysis upon recovery from a SYS_WOPR condition, the system sends the following message (iOID appears if the operator logged in):

System measuring: {SYS_MEASURING}{aMOD, iIID, aDATE, aTIME, iOID}

Calibration Pending

When the system is about to perform a calibration, the system sends the following message (iOID appears if the operator logged in):

Calibration pending: {SYS_CAL_PEND} {aMOD, iIID, aDATE, aTIME, iOID}

NOTE: The system sends the SYS_CAL_PEND message before the expected start of a calibration. However, the message is not sent during the cartridge initialization period.

If the calibration fails, the system repeats the calibration and sends the following message (iOID appears if the operator logged in):

Calibration repeating: {SYS_CAL_REP}{aMOD, iIID, aDATE, aTIME, iOID}

NOTE: The data from the repeated calibration replaces the data from the calibration that failed.

System Control Transactions

The LIS can configure the Rapidpoint 400 series system to prevent the operator from analyzing samples, to include and exclude parameters from analysis, and to perform 1-point and 2-point calibrations.

Sample Analysis Disabled

The LIS informs the system to disable sample analysis by sending the following message:

Sample analysis disabled: {CTL_LOCK}{aMOD, iIID}

When the system receives a request to disable analysis from the LIS, it sets a flag that prevents sample analysis at the Analysis screen. The system displays a message, on the screen where an operator enters their password, indicating that analysis is disabled. Analysis can be enabled by the LIS.

Sample Analysis Enabled

The LIS informs the system to enable sample analysis by sending the following message:

Sample analysis enabled: {CTL_FREE}{aMOD, iIID}

Parameter Enabled or Disabled

The LIS informs the system to enabled or disabled a parameter by sending the following message:

Parameter enabled or disabled: {CTL_CHAN}{parameter selection data}

When the system receives a request to enable or disable parameters {CTL_CHAN} from the LIS, the system sets flags to enable or disable the selected parameters during analysis. The parameters are disabled or enabled as defined by the status of the flags. The enable/disable selection is in effect until the system receives another {CTL_CHAN} message for the parameters or until the operator selects parameters in Setup at the Rapidpoint 400 series system.

The LIS may enable a parameter that has been disabled by the system because the parameter failed or missed QC by sending the following message:

Parameter enabled: {CTL_OVERRIDE_QC}{parameter selection data}

When the system receives the override request, the system enables the parameter.

The request to enable or disable a parameter includes a setup variable and the request to override a parameter includes a system variable. Refer to Appendix B, *Data Records*, for the fields sent in the parameter selection data record.

Calibration Requests

The LIS informs the system to perform a 1-point calibration by sending the follow message:

1-pt Calibration Request: {CTL_1PT} {aMOD, illD}

If the system can accommodate the request, it responds with the CAL_START message. Otherwise, no response is sent to LIS. The system may not be able to perform a 1-point calibration because of the following conditions:

- the system is in a retro-calibration period
- the system is busy and cannot perform a calibration at the time of the request
- the next calibration due is a 2-point or 2-point full calibration

The LIS may request a 2-point full calibration by sending the follow message:

2-pt Calibration Request: {CTL_2PT} {aMOD, illD}

If the system can accommodate the request, it responds with the CAL_START message. Otherwise, no response is sent to LIS. The system may not be able to perform a calibration because of the following conditions:

- the system is in retro-calibration period
- the system is busy and cannot perform a calibration at the time of the request

Date/Time Transaction

The date/time transaction is initiated by the LIS when it wants to determine the system's date and time:

Request time: {TIME_REQ}{aMOD, iIID}

The system responds by sending a data record containing the name and value of the variables aDATE and aTIME:

System time: {TIME_DATA}{aMOD, iIID, aDATE, aTIME}

3 Message Format

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Message Format

This section explains the rules for building messages and the rules for decoding the messages received. In this protocol, messages are enclosed within ASCII control characters so that the LIS can detect the start and end of transmission. The control characters and their meanings are listed alphabetically in the following table.

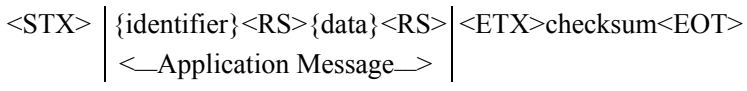
Control Character	*Meaning*
<ACK>	acknowledge
<EOT>	end of transmission
<ETB>	end of transmission block
<ETX>	end of text
<FS>	field separator
<GS>	group separator
<RS>	record separator
<STX>	start of text

NOTE: A shorthand notation is used to describe the transmitted messages with the format {identifier}{data}. The braces {. . .} are not actually transmitted, but are used in this document to delimit records.

Each message consists of an application message contained in a datalink frame. The frame consists of the following elements:

- a start-of-message character before the application message
- an end-of-message character at the end of the application message
- two checksum characters
- an end-of-transmission character

The format of the frame is as follows:



where:

<STX> is the ASCII control character Start of Text (02 decimal)

<RS> is the record separator (30 decimal)

<ETX> is the ASCII control character End of Text (03 decimal)

checksum is a variable, two-digit, hexadecimal number included to support error checking by the receiver

<EOT> is the ASCII control character End of Transmission (04 decimal)

Each application message consists of one or two records, each terminated by a record separator character. The first record, {identifier}, identifies the message type. If present, the second record, {data}, contains information that gives further identity to the message or provides data.

The identifier record is always transmitted first, and the characters given within the braces are transmitted exactly as shown in Section 2, *Message Transactions*.

The data record is transmitted second. The contents of the braces indicate the data fields to be sent, not the exact content of the record.

Application Message Format

The application message format uses delimiters to mark the beginning and end of a record. The identifier record and the data record are each terminated by the ASCII control character Record Separator (30 decimal), <RS>.

For example: {identifier}<RS>{data}<RS>

Identifier Record Format

The identifier record is a string of ASCII characters that describe the type of record being sent and is terminated by the ASCII control character Field Separator (28 decimal), <FS>.

For example: SMP_NEW_DATA<FS>

Data Record Format

The format of a data record is as follows:

{name}<GS>{value}<GS>{units}<GS>{exception group}<GS><FS>
{name}<GS>{value}<GS>{units}<GS>{exception group}<GS><FS>
{name}<GS>{value}<GS>{units}<GS>{exception group}<ETB><GS><FS> etc.

where:

<GS> is the ASCII control character Group Separator (29 decimal)

<FS> is the ASCII control character Field Separator (28 decimal)

<ETB>is the ASCII control character End of Transmission Block (23 decimal)

The allowable set of characters for each of the groups (name, value, units, and exceptions) is normally the set of all printable ASCII characters (codes 20 through 126, decimal).

The <GS> character terminates each group, including null groups. That is, every field in the record contains exactly four <GS> characters.

The <FS> character terminates every field of the record.

The <ETB> character terminates an exception group.

The number and ordering of the fields within the record is generally unconstrained.

The following example shows the complete structure of a sample data message from a Rapidpoint 400 system. The parameters listed in the example are a subset of the actual parameters that can be transmitted. Refer to Appendix A, *Variables*, for a complete list of parameters.

In the sample data message that follows, the identifier record, SMP_EDIT_DATA, indicates that the data record contains patient sample data that was recalled and edited at the Rapidpoint 400 system. Within the data record, the Rapidpoint 400 system identifies itself by the model number (aMOD), 0401, and the device ID (iIID), 12345. The patient identifier (iPID) is entered as 25.

<STX>SMP_EDIT_DATA<FS><RS>aMOD<GS>0401<GS><GS><GS><FS>
iIID<GS>12345<GS><GS><GS><FS>rDATE<GS>11Oct2000<GS><GS><GS>
<FS>rDEVICE<GS>SYRINGE<GS><GS><GS><FS>rTIME<GS>16:20:36
<GS><GS><GS><FS>rTYPE<GS>SAMPLE<GS><GS><GS><FS>iSOURCE
<GS>ARTERIAL<GS><GS><GS><FS>rSEQ<GS>56<GS><GS><GS><FS>
rCartID<GS>970506816<GS><GS><GS><FS>mpH<GS><GS><GS>QUES
<ETB><GS><FS>mPCO2<GS><GS>mmHg<GS><<ETB><GS><FS>mPO2
<GS>183.3<GS>mmHg<GS><GS><FS>mNa+<GS>118.5<GS>mmol/L<GS>
<GS><FS>mK+<GS>5.25<GS>mmol/L<GS><GS><FS>mCa++<GS>0.76<GS>
mmol/L<GS><GS><FS>mCl<GS>91<GS>mmol/L<GS><GS><FS>mGlucose
<GS>60<GS>mg/dL<GS><GS><FS>mHct<GS><GS>%<GS><<ETB><GS>
<FS>iPID<GS>25<GS><GS><GS><FS>iLNAME<GS>ARTERY<GS><GS>
<GS><FS>iSEX<GS>M<GS><GS><GS><FS>iDOB<GS>12Dec1912<GS>
<GS><GS><FS>iROOM<GS>2525<GS><GS><GS><FS>iDID<GS>25<GS>
<GS><GS><FS>iDATE<GS>11Oct2000<GS><GS><GS><FS>iTIME<GS>
16:20<GS><GS><GS><FS>iACC<GS>47<GS><GS><GS><FS>iOID<GS>42
<GS><GS><GS><FS>iTEMP<GS>37.0<GS>C<GS><GS><FS>itHb<GS>14.0
<GS>g/dL<GS><GS><FS>iFIO2<GS>23.0<GS>%<GS><GS><FS>iFlow<GS>
27.00<GS>L/min<GS><GS><FS>iRR<GS>17.0<GS>bpm<GS><GS><FS>
cPO2/FIO2<GS><GS>mmHg/%<GS>><ETB><GS><FS>cPO2<GS>183.3<GS>
mmHg<GS><GS><FS><RS><ETX>[chksum]<EOT>

Data Record Field Contents

A data record generally consists of multiple fields, each field containing the results of a particular parameter or the data for an assay (run) variable or a demographic variable.

Each field within a data record must contain the following four parts or groups in this fixed sequence: name, value, units, and exceptions. The ASCII control character <GS> terminates each group in the field. All four group separators must be sent, even if one or more of the groups is null.

Often the exceptions group, which conveys an abnormal condition for a parameter, is null. In some cases, the value group is null when the exceptions group contains an exception. The value group and the exceptions group cannot both be null. The name group cannot be null. The units group can be null. Two examples from data records are described in the table below.

This field . . .	*Means that . . .*
mNa+<GS>140.3<GS>mmol/L <GS><GS><FS>	the parameter measured Na^+ (sodium-ion concentration) has a value of 140.3, the units of measure are millimoles per liter, and there are no exceptions.
mPCO2<GS><GS>mmHg<GS>< <ETB><GS><FS>	the parameter measured pCO_2 (carbon dioxide [partial pressure]) has no reported value, the units of measure are millimeters of mercury, and a sample below reporting range (<) exception is reported.

The sections that follow describe the content and format of each of the four groups.

Name Group

Each name group is a string of ASCII characters of arbitrary length corresponding to a variable name. A name group is the first group of every field in the record. Refer to Appendix A, *Variables*, for a list of variable names.

The case of each character (upper case or lower case) is significant. The first character of the name is always lower case and provides the following information:

This character . . .	*Indicates that the variable is . . .*
m	measured by the system.
c	calculated by the system.
i	entered by an operator.
a, r, s	assigned by the system.

Any field can be omitted from a data record if no value or exception is being reported. The LIS must be able to receive fields in any order.

NOTE: The manufacturer reserves the right at any time without notice to change the fields and the order of fields that the Rapidpoint 400 series system transmits.

Value Group

Each value group is a string of ASCII characters of arbitrary length, corresponding to the value of the variable in that field. The value group is the second group of every field in the record and immediately follows the name group. Refer to Appendix A, *Variables*, for the format of variable values.

All parameter variables have numeric values. Other variables have alphanumeric values.

Dates are sent in the format nnAaannnn, consisting of two digits for day of the month, a three-character abbreviation of the month, and all four digits of the year.

Month abbreviations are: Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec.

Times are sent in the format nn:nn:nn in standard 24-hour time. The exception to this is iTIME, which is sent in the format nn:nn.

Units Group

Each units group is a string of ASCII characters of arbitrary length, corresponding to the unit of measure for a parameter value. The units group is the third group of every field in the record. The units group is always null for any variables, such as patient last name, that are not parameters. Refer to Appendix B, *Data Records*, for a list of units of measure.

The units transmitted in the units group are those selected at the Rapidpoint 400 series system for reporting results for each parameter. Some parameters have fixed units, in which case the data in the units group for each of these parameters is always the same. For example, the units for Na^+ are always mmol/L. Certain parameters do not report units, in which case the units group is null. For example, the units group is null for any parameters for which the results are reported as decimal fractions.

Exception Group

Each exception group is a string of ASCII characters of arbitrary length, corresponding to the mnemonics for abnormal conditions. Up to two exceptions can be transmitted in any one exception group. If exceptions are transmitted, they are delimited by a trailing <ETB> (23 decimal). The exception group is the last group in the field.

The format of the exception group depends on the number of exceptions:

This format is sent . . .	*When there are . . .*
<GS>	no exceptions.
exception<ETB><GS>	one exception.
exception<ETB> exception<ETB><GS>	two exceptions.

An exception group in the field of a data record can provide additional encoded information about the parameter value reported. An exception group identifies data that is outside the reporting or established range for patient or QC samples, respectively, and other conditions that affect interpretation of the results for the parameter. It is, of course, the operator's responsibility to accept or reject any parameter result received with an associated exception.

Any exception code supported by the Rapidpoint 400 series system can be reported for measured parameters. Only the exception code for out of reporting range flags can be reported for calculated parameters.

The following exception codes can be transmitted with patient and QC sample results:

Code	*Meaning*
<	below reporting range
>	above reporting range
H	above established range for patient or QC
L	below established range for patient or QC
UNCOR	uncorrected result for this parameter (patient samples only)
QUES	questionable result for this parameter
SULF	CO-ox results corrected for sulfHb interference
CTEMP	CO-ox results are unavailable because of a CO-ox temperature problem
COOXERR	CO-ox error occurred

The following codes can be transmitted with calibration data:

Code	*Meaning*
<	below reporting range
>	above reporting range
OFFO	electrode offset out of range

(Continued)

Code	Meaning
SLPO	electrode slope out of range
DRIFT	electrode drift or interfering substance on glucose sensor or electrode noise
CALREP	repeating calibration because it failed
COOXERR	CO-ox error occurred

NOTE: For CO-ox, the variable name is aZmtHb if the CO-ox zero failed.

4 Message Transfer

Message Transfer **4-3**
Acknowledgement Format 4-3
Message Acknowledgment 4-3
Error Detection 4-4
Maximum Transmission Size 4-5
Examples Using the Protocol 4-5

Message Transfer

The protocol uses message acknowledgments and message retry on no acknowledgment. The system's communication protocol builds the message to be transmitted into a frame that includes a checksum for error detection.

Acknowledgement Format

The format of an acknowledgment is as follows:

<STX><ACK><ETX>checksum<EOT>

where:

<STX> is the ASCII control character Start of Text (02 decimal)

<ACK> is the ASCII control character Acknowledge (06 decimal)

<ETX> is the ASCII control character End of Text (03 decimal)

<EOT> is the ASCII control character End of Transmission (04 decimal)

This transmission format is identical to the format used for message transmissions and therefore allows the interrupt mechanism to easily detect start and end of transmissions.

Message Acknowledgment

The LIS and the Rapidpoint 400 series system system perform the following functions to implement the acknowledgment protocol.

If . . .	*Then . . .*
the system has a message to transmit to the LIS	the system transmits the message and starts a timer. The system then waits to receive an acknowledgment from the receiver, and sets the variable RETRY = FALSE (transaction started).
the LIS receives a good message (no parity/framing errors or checksum error)	the LIS transmits an acknowledgment to the system, and passes the message onto higher levels of the application code.
the system timer expires and RETRY = FALSE	the system retransmits the message and restarts the timer. The system also sets the variable RETRY = TRUE.
the system timer expires and RETRY = TRUE	the system logs an error (t ransaction complete).

(Continued)

If . . .	*Then . . .*
the system receives a bad message	the system ignores the message.
the system receives an acknowledgment message from the LIS	the system stops the timer (transaction complete).

The retry timer that the system (or LIS) implements does not start until the last character in the message has been transmitted. The timer duration depends upon baud rate, as follows:

Baud	19200	9600	4800	2400	1200
Timer (secs)	5	6	8	11	17

The checksum for this fixed content acknowledgment is 0B, making the acknowledgment message:

<STX><ACK><ETX>0B<EOT>

Error Detection

The protocol includes a checksum that consists of two ASCII characters that represent a two-character hexadecimal number in the range 00 through FF.

The hexadecimal number is generated by performing a modulo-256_{10} summation of all the previous characters in the frame (i.e., over the range <STX>. . .<ETX>, inclusive) and then expressing the resulting 8-bit unsigned integer in hexadecimal format.

For example, consider the following ID_DATA message:

<STX>ID_DATA<FS><RS>aMOD<GS>LIS<GS><GS><GS>
<FS>iIID<GS>333<GS><GS><GS><FS><RS><ETX>84<EOT>

The aMOD field must be LIS as shown, but the iIID field can be any alphanumeric characters (up to 6).

The summation of the value of each character in the string and the resulting hexadecimal number are described following table:

	Decimal	*Hexadecimal*
Summation	1924	784
Modulo 256_{10}	132	84

The checksum is transmitted as the two ASCII characters 8 and 4 (8 is 56 decimal, hex 38, and 4 is 52 decimal, hex 34).

Maximum Transmission Size

The Rapidpoint 400 series system transmits messages of up to 2500 characters, including all control characters and the checksum.

Examples Using the Protocol

This section provides three examples that describe some of the messages transmitted using the communication protocol.

Example A: Device Identify Transaction

Example A describes the messages transmitted during system port configuration. The content of the messages is explained in the message key following the transaction table. The LIS must respond with the correct ID_DATA message for the system to recognize the LIS connection and allow transmission of further messages.

The ID_REQ/ ID_DATA trans action described in the following table is initiated on system or port start-up by the Rapidpoint 400 series system and is required for the LIS to conform to the protocol.

Rapidpoint 400 Series System		*LIS*
ID Request (Message 1)	→	
	←	Acknowledge (Message 2)
	←	ID data (Message 3)
Acknowledge (Message 2)	→	

NOTE: The acknowledge message must be issued within the retry time for the specified baud rate.

Message Key:

Message 1

<STX>ID_REQ<FS><RS><ETX>13<EOT>

Message 2

<STX><ACK><ETX>0B<EOT>

Message 3

<STX>ID_DATA<FS><RS>aMOD<GS>LIS<GS><GS><GS><FS>iIID
<GS>333<GS><GS><GS><FS><RS><ETX>84<EOT>

Example B: Patient Sample Analysis

Example B describes the messages transmitted during a typical patient sample analysis for a Rapidpoint 400 system. The content of the messages is explained in the message key following the transaction table.

Rapidpoint 400 System		*LIS*
System Not Ready (Message 1)	→	
	←	Acknowledge (Message 2)
Sample Start (Message 3)	→	
	←	Acknowledge (Message 2)
System Waiting (Message 4)	→	
	←	Acknowledge (Message 2)
System Measuring (Message 5)	→	
	←	Acknowledge (Message 2)
New Sample Available (Message 6)	→	
	←	Acknowledge (Message 2)
	←	Sample Request (Message 7)
Acknowledge (Message 2)	→	
Sample New Data (Message 8)	→	
	←	Acknowledge (Message 2)
System Ready (Message 9)	→	
	←	Acknowledge (Message 2)

Message Key:

Message 1

<STX>SYS_NOT_READY<FS><RS>aMOD<GS>0401<GS><GS><GS><FS>
iIID<GS>12345<GS><GS><GS><FS>aDATE<GS>20Jan1997<GS><GS><GS>
<FS>aTIME<GS>13:33:17<GS><GS><GS><FS>iOID<GS>3<GS><GS><GS>
<FS><RS><ETX>{chksum}<EOT>

Message 2

<STX><ACK><ETX>0B<EOT>

Message 3

<STX>SMP_START<FS><RS>aMOD<GS>0401<GS><GS><GS><FS>iIID
<GS>12345<GS><GS><GS><FS>aDATE<GS>20Jan1997<GS><GS><GS>
<FS>aTIME<GS>13:33:19<GS><GS><GS><FS>iOID<GS>3<GS><GS><GS>
<FS><RS><ETX>{chksum}<EOT>

Message 4

<STX>SYS_WOPR<FS><RS>aMOD<GS>0401<GS><GS><GS><FS>iIID
<GS>12345<GS><GS><GS><FS>aDATE<GS>20Jan1997<GS><GS><GS>
<FS>aTIME<GS>13:33:41<GS><GS><GS><FS>iOID<GS>3<GS><GS><GS>
<FS><RS><ETX>{chksum}<EOT>

Message 5

<STX>SYS_MEASURING<FS><RS>aMOD<GS>0401<GS><GS><GS><FS>
iIID<GS>12345<GS><GS><GS><FS>aDATE<GS>20Jan1997<GS><GS><GS>
<FS>aTIME<GS>13:33:44<GS><GS><GS><FS>iOID<GS>3<GS><GS><GS>
<FS><RS><ETX>{chksum}<EOT>

Message 6

<STX>SMP_NEW_AV<FS><RS>aMOD<GS>0401<GS><GS><GS><FS>iIID
<GS>12345<GS><GS><GS><FS>rSEQ<GS>16<GS><GS><GS><FS><RS>
<ETX>{chksum}<EOT>

Message 7

<STX>SMP_REQ<FS><RS>aMOD<GS>0401<GS><GS><GS><FS>iIID<GS>
12345<GS><GS><GS><FS>rSEQ<GS>16<GS><GS><GS><FS><RS><ETX>
{chksum}<EOT>

Message 8

<STX>SMP_NEW_DATA<FS><RS>aMOD<GS>0401<GS><GS><GS><FS>
iIID<GS>12345<GS><GS><GS><FS>rDATE<GS>20Jan1997<GS><GS><GS>
<FS>rDEVICE<GS>SYRINGE<GS><GS><GS><FS>rTIME<GS>13:33:15
<GS><GS><GS><FS>rTYPE<GS>SAMPLE<GS><GS><GS><FS>iSOURCE
<GS>ARTERIAL<GS><GS><GS><FS>rSEQ<GS>16<GS><GS><GS><FS>
rCartID<GS>834437404<GS><GS><GS><FS>mpH<GS>7.391<GS><GS>
<GS><FS>mPCO2<GS>25.3<GS>mmHg<GS>L<ETB><GS><FS>mPO2<GS>
181.1<GS>mmHg<GS>H<ETB><GS><FS>mNa+<GS>155.6<GS>mmol/L
<GS>H<ETB><GS><FS>mK+<GS>3.11<GS>mmol/L<GS>L<ETB><GS><FS>
mCa++<GS>1.63<GS>mmol/L<GS>L<ETB><GS><FS>mCl-<GS>121<GS>
mmol/L<GS>H<ETB><GS><FS>mGlucose<GS>41<GS>mg/dL<GS>L<ETB>
<GS><FS>mHct<GS><GS>%<GS><<ETB><GS><FS>iPID<GS>123<GS>
<GS><GS><FS>iLNAME<GS>AV-A<GS><GS><GS><FS>iSEX<GS>F<GS>
<GS><GS><FS>iDOB<GS>12Dec1912<GS><GS><GS><FS>iROOM<GS>
556325884<GS><GS><GS><FS>iDID<GS>321456<GS><GS><GS><FS>
iDATE<GS>20Jan1997<GS><GS><GS><FS>iTIME<GS>14:30<GS><GS>
<GS><FS>iACC<GS>9876543210<GS><GS><GS><FS>iOID<GS>3<GS>
<GS><GS><FS>iTEMP<GS>35.9<GS>C<GS><GS><FS>iFIO2<GS>50.0
<GS>%<GS><GS><FS>iFlow<GS>12.00<GS>L/min<GS><GS><FS>iRR<GS>
16.0<GS>bpm<GS><GS><FS>cHCO3act<GS>15.0<GS>mmol/L<GS><GS>
<FS>cBE(vv)<GS>-9.9<GS>mmol/L<GS><GS><FS>cctCO2<GS>15.8<GS>
mmol/L<GS><GS><FS>cCa++<GS>1.62<GS>mmol/L<GS><GS><FS>
cAnGap<GS>22.7<GS>mmol/L<GS><GS><FS>cPO2/FIO2<GS>3.62<GS>
mmHg/%<GS><GS><FS>cpH<GS>7.407<GS><GS><GS><FS>cPO2<GS>
175.2<GS>mmHg<GS><GS><FS>cPCO2<GS>24.1<GS>mmHg<GS><GS>
<FS><RS><ETX>{chksum}<EOT>

Message 9

<STX>SYS_READY<FS><RS>aMOD<GS>0401<GS><GS><GS><FS>iIID
<GS>12345<GS><GS><GS><FS>aDATE<GS>20Jan1997<GS><GS><GS>
<FS>aTIME<GS>13:35:32<GS><GS><GS><FS>iOID<GS>3<GS><GS><GS><
FS><ETX>{chksum}<EOT>

Example C: Edited Patient Sample Data

Example C describes the messages transmitted during the transmission of edited patient sample data (in this case an arterial sample) for a Rapidpoint 400 system. The content of the messages is explained in the message key following the transaction table.

Rapidpoint 400 System		*LIS*
System Not Ready (Message 1)	→	
	←	Acknowledge (Message 2)
New Sample Available (Message 3)	→	
	←	Acknowledge (Message 2)
	←	Sample Request (Message 4)
Acknowledge (Message 2)	→	
Edit Sample Data (Message 5)	→	
	←	Acknowledge (Message 2)
System Ready (Message 6)	→	
	←	Acknowledge (Message 2)

Message Key:

Message 1

<STX>SYS_NOT_READY<FS><RS>aMOD<GS>0401<GS><GS><GS><FS>
iIID<GS>12345<GS><GS><GS><FS>aDATE<GS>11Oct2000<GS><GS><GS>
<FS>aTIME<GS>16:23:30<GS><GS><GS><FS><RS><ETX>[chksum]<EOT>

Message 2

<STX><ACK><ETX>0B<EOT>

Message 3

<STX>SMP_NEW_AV<FS><RS>aMOD<GS>0401<GS><GS><GS><FS>iIID
<GS>12345<GS><GS><GS><FS>rSEQ<GS>56<GS><GS><GS><FS><RS>
<ETX>[chksum]<EOT>

Message 4

<STX>SMP_REQ<FS><RS>aMOD<GS>0401<GS><GS><GS><FS>iIID<GS>
12345<GS><GS><GS><FS>rSEQ<GS>56<GS><GS><GS><FS><RS><ETX>
[chksum]<EOT>

Message 5

<STX>SMP_EDIT_DATA<FS><RS>aMOD<GS>0401<GS><GS><GS><FS>
iIID<GS>12345<GS><GS><GS><FS>rDATE<GS>11Oct2000<GS><GS><GS>
<FS>rDEVICE<GS>SYRINGE<GS><GS><GS><FS>rTIME<GS>16:20:36
<GS><GS><GS><FS>rTYPE<GS>SAMPLE<GS><GS><GS><FS>iSOURCE
<GS>ARTERIAL<GS><GS><GS><FS>rSEQ<GS>56<GS><GS><GS><FS>
rCartID<GS>970506816<GS><GS><GS><FS>mpH<GS><GS><GS>QUES
<EB><GS><FS>mPCO2<GS><GS>mmHg<GS><<ETB><GS><FS>mPO2
<GS>183.3<GS>mmHg<GS><GS><FS>mNa+<GS>118.5<GS>mmol/L<GS>
<GS><FS>mK+<GS>5.25<GS>mmol/L<GS><GS><FS>mCa++<GS>0.76<GS>
mmol/L<GS><GS><FS>mCl<GS>91<GS>mmol/L<GS><GS><FS>mGlucose
<GS>60<GS>mg/dL<GS><GS><FS>mHct<GS><GS>%<GS><<ETB><GS>
<FS>iPID<GS>25<GS><GS><GS><FS>iLNAME<GS>ARTERY<GS><GS>
<G><FS>iSEX<GS>M<GS><GS><GS><FS>iDOB<GS>12Dec1912<GS>
<GS><GS<FS>iROOM<GS>2525<GS><GS><GS><FS>iDID<GS>25<GS>
<GS><GS><FS>iDATE<GS>11Oct2000<GS><GS><GS><FS>iTIME<GS>
16:20<GS><G><GS><FS>iACC<GS>47<GS><GS><GS><FS>iOID<GS>42
<GS><GS><GS><FS>iTEMP<GS>37.0<GS>C<GS><GS><FS>itHb<GS>14.0
<GS>g/dL<GS><GS><FS>iFIO2<GS>23.0<GS>%<GS><GS><FS>iFlow<GS>
27.00<GS>L/min<GS><GS><FS>iRR<GS>17.0<GS>bpm<GS><GS><FS>
cPO2/FIO2<GS><GS>mmHg/%<GS>><ETB><GS><FS>cPO2<GS>183.3<GS>
mmHg <GS><GS><FS><RS><ETX>[chksum]<EOT>

Message 6

<STX>SYS_READY<FS><RS>aMOD<GS>0401<GS><GS><GS><FS>iIID
<GS>12345<GS><GS><GS><FS>aDATE<GS>11Oct2000<GS><GS><GS>
<FS>aTIME<GS>16:24:11<GS><GS><GS><FS><RS><ETX>[chksum]<EOT>

5 Physical Interface

Physical Interface **5-3**
Architecture 5-3
Hardware Link 5-3
Character Format 5-4

Physical Interface

Architecture

The basic architecture is point-to-point communications between the LIS and the Rapidpoint 400 series system.

Hardware Link

The hardware link consists of a serial asynchronous (RS-232) interface. Communication is normally full duplex at one of the following user-selected baud rates:

- 19200
- 9600
- 4800
- 2400
- 1200

The system interface port is equipped with a 9-pin, D-type, male connector.

The systems are considered to be Data Terminal Equipment (DTE). The DTE lines that are supported are listed below.

DTE Line	*Pin Number*
Data Carrier Detect (not used)	Pin 1
Received Data	Pin 2
Transmitted Data	Pin 3
Data Terminal Ready (not used)	Pin 4
Signal Ground	Pin 5
Data Set Ready (not used)	Pin 6
Request to Send (not used)	Pin 7
Clear to Send (not used)	Pin 8
Ring Indicator (not used)	Pin 9

Character Format

You can select the following character format options when you select the LIS communication parameters in setup at the Rapidpoint 400 series system.

Option	Selection
data bits	7 bits, 8 bits
parity	odd, even, none
modem (duplex)	none, full

The stop bits are set to 1.

Appendix A: Variables

The tables in this appendix list the fields that can appear in messages sent by either the Rapidpoint 400 series system or the LIS.

Parameter Variables

The variable names listed in the table below are the parameters for the Rapidpoint 400 series system. The lowercase prefix at the beginning of each variable name to indicate that the parameter is measured (m) or calculated (c). For example, AnGap becomes cAnGap.

Variable Name	Parameter	Unit of Measure
mpH	pH	pH units
mH+	H^+	nmol/L
mPCO2	pCO_2	mmHg or kPa
mPO2	pO_2	mmHg or kPa
mNa+	Na^+	mmol/L
mK+	K^+	mmol/L
mCa++	Ca^{++}	mmol/L or mg/dL
mCl–	Cl^-	mmol/L
mGlucose	Glu	mg/dL or nmol/L
mSO2	sO_2	% or fraction
mHct	Hct	% or fraction
mtHb	tHb	g/dL, g/L, mmol/L
mO2Hb	FO_2Hb	% or fraction
mCOHb	*F*COHb	% or fraction
mMetHb	*F*MetHb	% or fraction
mHHb	*F*HHb	% or fraction
mPO2(v)	pO_2(v)	mmHg or kPa
mtHb(v)	tHb(v)	g/dL, g/L, mmol/L
mO2Hb(v)	O_2Hb(v)	% or fraction
cHCO3act	HCO_3^-act	mmol/L

(Continued)

Variable Name	*Parameter*	*Unit of Measure*
cHCO3std	HCO_3^-std	mmol/L
cBE(vt)	BE(B)	mmol/L
cBE(vv)	BE(ecf)	mmol/L
ctCO2	*c*tCO_2	mmol/L
cCa++	Ca^{++}(7.4)	mmol/L or mg/dL
cAnGap	AnGap	mmol/L
cO2SAT	O_2SAT(est)	% or fraction
ctHb(est)	*c*tHb(est)	g/dL, g/L, or mmol/L
cPO2/FIO2	*p*O_2/F_IO_2	mmHg% or kPa%
cpH	pH(T)	pH units
cH+	H^+(T)	nmol/L
cPCO2	pCO_2(T)	mmHg or kPa
cPO2	pO_2(T)	mmHg or kPa
cRI	RI(T)	fraction or %
cSO2	*s*O_2	% or fraction
cHct	Hct	% or fraction
cO2CAP	BO_2	mL/dL, mL/L, mmol/L
cA-aDO2	*p*O_2(A-a)(T)	mmHg, kPa
ca/A	*p*O_2(a/A)(T)	decimal or %
cP50	*p*50	mmHg, kPa
cQsp/Qt	$\dot{Q}$sp/$\dot{Q}$t(T)	% or fraction
cQsp/Qt(est)	$\dot{Q}$sp/$\dot{Q}$t(T)(est)	% or fraction
cctO2(Hb)	*c*tO_2(Hb)	mL/dL, mL/L, mmol/L
cctO2(a)	*c*tO_2(a)	mL/dL, mL/L, mmol/L
cctO2(v)	*c*tO_2($\bar{v}$)	mL/dL, mL/L, mmol/L
cctO2(v)	*c*tO_2(v)	mL/dL, mL/L, mmol/L
cctO2(a-v)	*c*tO_2(a-$\bar{v}$)	mL/dL, mL/L, mmol/L
cctO2[(a-v)/a]	*c*tO_2([a-$\bar{v}$]/a)	% or fraction
DO2	$\dot{D}O_2$	mL/min, L/min, mmol/min
VO2	$\dot{V}O_2$	mL/min, L/min, mmol/min

Entered Variables

Entered variables are indicated by the prefix i (input). These variables can be patient or sample demographic values, such as iPID (patient ID) and iSOURCE (sample source). They can also be values that relate to the configuration of QC files, such as iQLEV (an identifier of QC). The units for the variables listed below are all null fields, unless otherwise noted.

Variable Name	*Variable Description*
iPID	patient ID
iFNAME	patient first name
iLNAME	patient last name (surname)
iSEX	patient sex (M, F, or U)
iDOB	patient birth date
iROOM	patient location
iDID	physician ID
iDATE	patient sample collection date
iROOM	patient location
iDID	physician ID
iDATE	patient sample collection date
iTIME	patient sample collection time
iACC	accession number
iOID	operator ID
iTEMP	temperature C or F
itHb	*c*tH bg/dL, g/L, or mmol/L
iFIO2	F_IO_2 fraction or %
iFlow	Flow L/min
iRR	Resp. Rate b/min
iBP	*p*Atm mmHg or kPa

(Continued)

Variable Name	*Variable Description*
iOBF	O_2 binding factor fraction
ictO2(a-v)	*c*tO_2(a-v) mL/dL, mL/L, mmol/L
iQt	QT L/min
iQDATE	QC expiration date
iQID	QC material identifier
iQLEV	level identifier of QC material
iQLOT	lot identifier of QC material
iSOURCE	sample source (ARTERIAL, VENOUS, CAPILLARY, ARTERIAL-VENOUS, OR MIXEDV)

Assay (Run) Variables

Assay variables are included in patient sample data, QC data, and calibration data records to distinguish one analysis (run) from another, and also to identify the type of analysis performed. Assay variables are prefixed by the letter r. The rSEQ variable appears in messages that indicate the availability of data and is required in messages requesting data. The assay variables are listed in the following table:

Variable Name	*Variable Description*
rDATE	analysis data
rDEVICE	sample device (CAPILLARY, SYRINGE, AMPULE, or AQC)
rSEQ	sequence number for this analysis
rTIME	time of analysis
rCartID	serial number of measurement cartridge
rAQCID	serial number of AutomaticQC cartridge
rTYPE	analysis type (SAMPLE)
rAVSEQ	sequence number for an a-v study report where the sequence number is the combination of the sequence number of the arterial sample and the mixed-venous sample with a slash (/) separating the two numbers

System Variables

The system variables aMOD and iIID are included in all data records except the Device Identity request (ID_REQ). The LIS must provide the aMOD field as LIS in the ID_DATA message.

NOTE: The calibration data fields aCmname, aCdname, aSmname, and aSdname also represent system variables.

System variables are prefixed by the letter a, except IID, which is prefixed by the letter i. In the system variable, *name* is replaced by the name of a particular parameter. For example, aCmname becomes aCmPO2 when the calibration point of pO_2 is measured.

System Variable	*Variable Description*
aMOD	model number (system identifier)
iIID	instrument identifier
aCmname	cal point measured of parameter named
aCdname	cal point drift of parameter named
aSmname	slope point measured of parameter named
aSdname	slope drift of parameter named
aZmtHb	CO-ox zero calibration failed

Setup Variables

The setup variable sDISname appears in the data record that the system sends in the Parameter Enabled/Disabled transaction. Setup variable sHQname and sLQname may be included in QC data records to indicate high and low limits entered into the system for the target range. Setup variables are prefixed by the letter *s*.

In the setup variable, *name* is replaced by the name of a particular parameter. For instance, sDISname becomes sDISGlucose when the Glucose parameter has been disabled.

Setup Variable	*Variable Description*
sDISname	disable channel for parameter named
sHQname	high QC warning limit of parameter named
sLQname	low QC warning limit of parameter named

Refer to *Parameter Selection Data Record* in Appendix B for the variable names.

Appendix B: Data Records

Appendix B contains the following data records:

- patient sample assay
- QC
- calibration
- parameter selection

The following table is a key to interpreting all value formats described in Appendix B. Use of the letter n in parentheses in the value field indicates variance in parameter resolution based on the units of measure in which the Rapidpoint 400 series system reports the results.

Value	*Description*
n	integer (0 through 9)
.	decimal point
A	upper case alphabetic character (A through Z)
a	lower case alphabetic character (a through z)

Patient Sample Assay Data Record

The following table lists the variables included in the patient sample assay data record.

Variable Name	*Value*	*Unit of Measure*
aMOD	040n	null field
iIID	up to 6 alphanumeric characters	null field
rCartID	up to 10 alphanumeric characters	null field
rTYPE	SAMPLE	null field
rSEQ	nnnnn...(2^{32})	null field
rAVSEQ	nnnnn...(2^{32})/nnnnn...(2^{32})	null field
iACC	up to 13 alphanumeric characters	null field
rDATE	nnAaannnn	null field
rTIME	nn:nn:nn	null field

(Continued)

Variable Name	*Value*	*Unit of Measure*
iPID	up to 13 alphanumeric characters	null field
iFNAME	up to 15 alphabetic characters	null field
iLNAME	up to 15 alphabetic characters	null field
iDATE	nnAaannnn	null field
iTIME	nn:nn	null field
iOID	up to 13 alphanumeric characters	null field
iROOM	up to 11 alphanumeric characters	null field
iDOB	nnAaannnn	null field
iSEX	M, F, or U	null field
iDID	up to 13 alphanumeric characters	null field
iSOURCE	ARTERIAL VENOUS CAPILLARY ARTERIAL-VENOUS MIXEDV	null field
rDEVICE	SYRINGE CAPILLARY	null field
mpH	n.nnn	null field
or		
mH+	nnn.n	nmol/L
mPCO2	nnn.n nn.nn	mmHg kPa
mPO2	nnn.n nn.nn	mmHg kPa
mNa+	nnn.n	mmol/L
mK+	nn.nn	mmol/L
mCa++	n.nn n.nn	mmol/L mg/dL
mCl-	nnn	mmol/L
mGlucose	nnn nnn.n	mg/dL mmol/L
mHct	nn n.nn	% null field

(Continued)

Variable Name	*Value*	*Unit of Measure*
mSO2	nnn.n	%
	n.nn	null field
mtHb	nn.n	g/dL
	nnn	g/L
	nn.n	mmol/L
mO2Hb	nnn.n	%
	n.nnn	null field
mCOHb	nnn.n	%
	n.nnn	null field
mMetHb	nnn.n	%
	n.nnn	null field
mHHb	nnn.n	%
	n.nnn	null field
cHCO3act	nn.n	mmol/L
cHCO3std	nn.n	mmol/L
cBE(vt)	nn.n	mmol/L
cBE(vv)	nn.n	mmol/L
ctCO2	nn.n	mmol/L
cCa++	n.nn	mmol/L
	nn.n	mg/dL
cAnGap	nn.n	mmol/L
cO2SAT	nnn.n	%
	n.nn	null field
cPO2/FIO2	n.nn	mmHg/%
	n.nnn	kPa/%
cpH	n.nnn	null field
or		
cH+	nnn.n	nmol/L
cPCO2	nnn.n	mmHg
	nn.nn	kPa
cPO2	nnn.n	mmHg
	nn.nn	kPa
cRI	nn.nn	null field
	nnnn	%

(Continued)

Variable Name	*Value*	*Unit of Measure*
ctHb(est)	nn.n	g/dL
	nnn	g/L
	nn.n	mmol/L
cSO2	nnn.n	%
	n.nn	null field
cHct	nn	%
	n.nn	null field
cO2CAP	nn.n	mL/dL
	nnn	mL/L
	nn.n	mmol/L
cA-aDO2	nnn.n	mmHg
	nnn.nn	kPa
ca/A	n.nn	null field
	nnn	%
cP50	nn.n	mmHg
	nn.nn	kPa
cQsp/Qt	nnn.n	%
	n.nn	null field
cQsp/Qt(est)	nnn.n	%
	n.nn	null field
cctO2(Hb)	nn.n	mL/dL
	nnn	mL/L
	nn.n	mmol/L
cctO2(a)	nn.n	mL/dL
	nnn	mL/L
	nn.n	mmol/L
cctO2(v)	nn.n	mL/dL
	nnn	mL/L
	nn.n	mmol/L
cctO2(v)	nn.n	mL/dL
	nnn	mL/L
	nn.n	mmol/L
cctO2(a-v)	nn.n	mL/dL
	nnn	mL/L
	n.n	mmol/L
cctO2[(a-v)/a]	nnn	%
	n.nn	null field

(Continued)

Variable Name	*Value*	*Unit of Measure*
DO2	nnnn	mL/min
	n.nn	L/min
	nnn.n	mmol/min
VO2	nnnn	mL/min
	n.nn	L/min
	nnn.n	mmol/min
mtHb(v)	nn.n	g/dL
	nnn	g/L
	nn.n	mmol/L
mPO2(v)	nnn.n	mmHg
	nn.nn	kPa
mO2Hb(v)	nnn.n	%
	n.nnn	null field
ictO2(a-v)	nn.n	mL/dL
	nnn	mL/L
	n.n	mmol/L
iOBF	n.nn	null field
iTEMP	nn.n	C
	nnn.n	F
itHb	nn.n	g/dL
	nnn	g/L
	nn.n	mmol/L
iFIO2	nnn.n	%
	n.nnn	null field
iFlow	nn.nn	L/min
iBP	nnn	mmHg
	nnn.n	kPa
iQt	nn.nn	L/min

NOTE: Parameters that are arterial-venous only are entered in Setup and used only in a-v study reports. These parameters are transmitted with data for a-v study reports. OBF and ctO_2(a-v) can also appear in arterial samples that report estimated shunt.

QC Sample Data Record

The following table lists the variables included in the QC data record for gases and analytes. For variables included in the hematocrit control, see page B-9.

Variable Name	*Value*	*Unit of Measure*
aMOD	040n	null field
iID	up to 6 alphanumeric characters	null field
rCartID	up to 10 alphanumeric characters	null field
rTYPE	QC	null field
rSEQ	nnnnn...(2^{32})	null field
rDATE	nnAaannnn	null field
rDEVICE	AQC, SYRINGE, AMPULE	null field
rAQCID	up to 10 alphanumeric characters	null field (only for AutomaticQC)
rTIME	nn:nn:nn	null field
iQID	up to 16 alphanumeric characters	null field
iQLEV	1 alphanumeric character	null field
iQLOT	up to 10 alphanumeric characters	null field (not for AutomaticQC)
iQDATE	nnAaannnn	null field (only for Required QC)
iOID	up to 13 alphanumeric characters	null field
sLQmpH	n.nnn	null field
or		
sLQmH+	nnn.n	nmol/L
mpH	n.nnn	null field
or		
mH+	nnn.n	nmol/L
sHQmpH	n.nnn	null field
or		
sHQmH+	nnn.n	nmol/L
sLQmPCO2	nnn.n nn.nn	mmHg kPa
mPCO2	nnn.n nn.nn1	mmHg kPa

(Continued)

Variable Name	*Value*	*Unit of Measure*
sHQmPCO2	nnn.n nn.nn	mmHg kPa
sLQmPO2	nnn.n nn.nn	mmHg kPa
mPO2	nnn.n nn.nn	mmHg kPa
sHQmPO2	nnn.n nn.nn	mmHg kPa
sLQmNa+	nnn.n	mmol/L
mNa+	nnn.n	mmol/L
sHQmNa+	nnn.n	mmol/L
sLQmK+	nn.nn	mmol/L
mK+	nn.nn	mmol/L
sHQmK+	nn.nn	mmol/L
sLQmCl-	nnn	mmol/L
mCl-	nnn	mmol/L
sHQmCl-	nnn	mmol/L
sLQmCa++	n.nn nn.n	mmol/L mg/dL
mCa++	n.nn nn.n	mmol/L mg/dL
sHQmCa++	n.nn nn.n	mmol/L mg/dL
sLQmGlucose	nnn nn.n	mg/dL mmol/L
mGlucose	nnn nn.n	mg/dL mmol/L
sHQmGlucose	nnn nn.n	mg/dL mmol/L
sLQmtHb	nn.n nnn nn.n	g/dL g/L mmol/L
mtHb	nn.n nnn nn.n	g/dL g/L mmol/L

(Continued)

Variable Name	*Value*	*Unit of Measure*
sHQmtHb	nn.n	g/dL
	nnn	g/L
	nn.n	mmol/L
sLQmO2Hb	nnn.n	%
	n.nnn	null field
mO2Hb	nnn.n	%
	n.nnn	null field
sHQmO2Hb	nnn.n	%
	n.nnn	null field
sLQmCO2Hb	nnn.n	%
	n.nnn	null field
mCO2Hb	nnn.n	%
	n.nnn	null field
sHQmCO2Hb	nnn.n	%
	n.nnn	null field
sLQmMetHb	nnn.n	%
	n.nnn	null field
mMetHb	nnn.n	%
	n.nnn	null field
sHQmMetHb	nnn.n	%
	n.nnn	null field
sLQmHHb	nnn.n	%
	n.nnn	null field
mHHb	nnn.n	%
	n.nnn	null field
sHQmHHb	nnn.n	%
	n.nnn	null field

The following QC data record is transmitted if the control was for Hct A and B only.

Variable Name	*Value*	*Unit of Measure*
aMOD	040n	null field
iIID	up to 6 alphanumeric characters	null field
rCartID	up to 10 alphanumeric characters	null field
rTYPE	QC	null field
rSEQ	nnnnn...(2^{32})	null field
rDATE	nnAaannnn	null field
rDEVICE	AQC, SYRINGEAMPULE	null field
rAQCID	up to 10 alphanumeric characters	null field (only for Automatic QC)
rTIME	nn:nn:nn	null field
iQID	up to 16 alphanumeric characters	null field
iQLEV	1 alphanumeric character	null field
iQLOT	up to 10 alphanumeric characters	null field (not for Automatic QC)
iQDATE	nnAaannnn	null field (only for Required QC)
iOID	up to 13 alphanumeric characters	null field
sLQmHct	nn n.nn	% null field
mHct	nn n.nn	% null field
sHQmHct	nn n.nn	% null field

Calibration Data Record

The calibration records sent by a Rapidpoint 400 series system depend upon the type of calibration performed. There are three different calibration sequences:

- 1-point (cal only)
- 2-point (cal and slope)
- 2-point/full (cal, slope, and Hct slope)

Variables reported for a 1-point calibration are shown in the following table:

Variable Name	*Value*	*Unit of Measure*
aMOD	040n	null field
iIID	up to 6 alphanumeric characters	null field
rCartID	up to 10 alphanumeric characters	null field
rTYPE	1-POINT	null field
rSEQ	nnnnn...(2^{32})	null field
rDATE	nnAaannnn	null field
rTIME	nn:nn:nn	null field
iBP	nnn nnn.n	mmHg kPa
aCmpH	n.nnn	null field
or		
aCmH+	nnn.n	nmol/L
aCdpH	n.nnnn	null field
or		
aCdH+	nnn.nn	nmol/L
aCmPCO2	nnn.n nn.nn	mmHg kPa
aCdPCO2	nnn.nn nn.nnn	mmHg kPa
aCmPO2	nnn.n nn.nn	mmHg kPa
aCdPO2	nnn.nn nn.nn	mmHg kPa

(Continued)

Variable Name	Value	Unit of Measure
aCmNa+	nnn.n	mmol/L
aCdNa+	nnn.nn	mmol/L
aCmK+	nn.nn	mmol/L
aCdK+	nn.nnn	mmol/L
aCmCa++	n.nn nn.n	mmol/L mg/dL
aCdCa++	n.nnn nn.nn	mmol/L mg/dL
aCmCl-	nnn	mmol/L
aCdCl-	nnnn	mmol/L
aCmGlucose	nnn nn.n	mg/dL mmol/L
aCdGlucose	nnnn nn.nn	mg/dL mmol/L
aZmtHb (appears only if CO-ox zero failed)	nn.n nnn nn.n	g/dL g/L mmol/L

The 2-point calibration includes all calibration and slope data except Hct. Variables reported for a 2-point calibration are shown in the following table:

Variable Name	Value	Unit of Measure
aMOD	040n	null field
iIID	up to 6 alphanumeric characters	null field
rCartID	up to 10 alphanumeric characters	null field
rTYPE	2-POINT	null field
rSEQ	nnnnn...(2^{32})	null field
rDATE	nnAaannnn	null field
rTIME	nn:nn:nn	null field
iBP	nnn nnn.n	mmHg kPa
aCmpH	n.nnn	null field

(Continued)

Variable Name	Value	Unit of Measure
or		
aCmH+	nnn.n	nmol/L
aCdpH	n.nnn	null field
or		
aCdH+	nnn.n	nmol/L
aCmPCO2	nnn.n nn.nn	mmHg kPa
aCdPCO2	nnn.n nn.nn	mmHg kPa
aCmPO2	nnn.n nn.nn	mmHg kPa
aCdPO2	nnn.n nn.nn	mmHg kPa
aCmNa+	nnn.n	mmol/L
aCdNa+	nnn.n	mmol/L
aCmK+	nn.nn	mmol/L
aCdK+	nn.nn	mmol/L
aCmCa++	n.nn nn.n	mmol/L mg/dL
aCaCa++	n.nn nn.n	mmol/L mg/dL
aCmCl-	nnn	mmol/L
aCdCl-	nnn	mmol/L
aCmGlucose	nnn nn.n	mg/dL mmol/L
aCdGlucose	nnn nn.n	mg/dL mmol/L
aSmpH	n.nnn	null field
or		
aSmH+	nnn.n	nmol/L
aSdpH	n.nnn	null field

(Continued)

Variable Name	Value	Unit of Measure
or		
aSdH+	nnn.n	nmol/L
aSmPCO2	nnn.n nn.nn	mmHg kPa
aSdPCO2	nnn.n nn.nn	mmHg kPa
aSmPO2	nnn.n nn.nn	mmHg kPa
aSdPO2	nnn.n nn.nn	mmHg kPa
aSmNa+	nnn.n	mmol/L
aSdNa+	nnn.n	mmol/L
aSmK+	nn.nn	mmol/L
aSdK+	nn.nn	mmol/L
aSmCl-	nnn	mmol/L
aSdCl-	nnn	mmol/L
aSmCa++	n.nn n.nn	mmol/L mg/dL
aSdCa++	n.nn n.nn	mmol/L mg/dL
aSmGlucose	nnn nn.n	mg/dL mmol/L
aSdGlucose	nnn nn.n	mg/dL mmol/L

The data record for a 2-point/full calibration shown in the following table includes calibration and slope data including Hct:

Variable Name	Value	Unit of Measure
aMOD	040n	null field
iIID	up to 6 alphanumeric characters	null field
rCartID	up to 10 alphanumeric characters	null field
rTYPE	2-POINT	null field

(Continued)

Variable Name	*Value*	*Unit of Measure*
rSEQ	nnnnn...(2^{32})	null field
rDATE	nnAaann	null field
rTIME	nn:nn:nn	null field
iBP	nnn nnn.n	mmHg kPa
aCmpH+	n.nnn	null field
or		
aCmmH+	nnn.n	nmol/L
aCdpH+	n.nnn	null field
or		
aCdH+	nnn.n	nmol/L
aCmPCO2	nnn.n nn.nn	mmHg kPa
aCdPCO2	nnn.n nn.nn	mmHg kPa
aCmPO2	nnn.n nn.nn	mmHg kPa
aCdPO2	nnn.n nn.nn	mmHg kPa
aCmNa+	nnn.n	mmol/L
aCdNa+	nnn.n	mmol/L
aCmK+	nn.nn	mmol/L
aCdK+	nn.nn	mmol/L
aCmCa++	n.nn nn.n	mmol/L mg/dL
aCdCa++	n.nn nn.n	mmol/L mg/dL
aCmCl-	nnn	mmol/L
aCdCl-	nnn	mmol/L
aCmGlucose	nnn nn.n	mg/dL mmol/L
aCdGlucose	nnn nn.n	mg/dL mmol/L

(Continued)

Variable Name	Value	Unit of Measure
aSmpH+	n.nnn	null field
or		
aSmH+	nnn.n	nmol/L
aSdpH+	n.nnn	null field
or		
aSdH+	nnn.n	nmol/L
aSmPCO2	nnn.n nn.nn	mmHg kPa
aSdPCO2	nnn.n nn.nn	mmHg kPa
aSmPO2	nnn.n nn.nn	mmHg kPa
aSdPO2	nnn.n nn.nn	mmHg kPa
aSmNa+	nnn.n	mmol/L
aSdNa+	nnn.n	mmol/L
aSmK+	nn.nn	mmol/L
aSdK+	nn.nn	mmol/L
aSmCa++	n.nn n.nn	mmol/L mg/dL
aSdCa++	n.nn n.nn	mmol/L mg/dL
aSmCl-	nnn	mmol/L
aSdCl-	nnn	mmol/L
aSmGlucose	nnn nn.n	mg/dL mmol/L
aSdGlucose	nnn nn.n	mg/dL mmol/L
aCmHct	nnn.n n.nnn	% null field
aCdHct	nnn.n n.nnn	% null field
aSmHct	nnn.n n.nnn	% null field

(Continued)

Variable Name	*Value*	*Unit of Measure*
aSdHct	nnn.n	%
	n.nnn	null field
aSmtHb	nn.n	g/dL
	nnn	g/L
	nn.n	mmol/L
aSdtHb	nn.n	g/dL
	nnn	g/L
	nn.n	mmol/L
aZmtHb	nn.n	g/dL
(appears only if CO-ox	nnn	g/L
zero failed)	nn.n	mmol/L

Parameter Selection Data Record

This data record is appended to a {CTL_CHAN} identifier record to enable or disable one or more parameters during sample analysis. The enable/disable selection is in effect until it is changed by another {CTL_CHAN} message or by selecting the parameters in Setup at the Rapidpoint 400 series system.

The sDISname variable indicates whether the parameter identified by the variable name should be enabled or disabled. For example, sDISPO2 refers to the parameter PO_2. A 1 (one) in the value group will disable the channel, while a 0 (zero) will enable the channel. sDISpH^+ will disable pH or H^+.

Variable Name	*Value*
aMOD	040n
iIID	up to 6 alphanumeric characters
sDISpH+	0 or 1
sDISPCO2	0 or 1
sDISPO2	0 or 1
sDISNa+	0 or 1
sDISK+	0 or 1
sDISCa++	0 or 1
sDISCl-	0 or 1
sDISGlucose	0 or 1
sDISHct	0 or 1
sDIStHb	0 or 1

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